

A copy of these claims, with amendments marked, is appended to the present Response.

### **REMARKS**

This amendment is responsive to the Office Action dated October 4, 2002. Amended claims 18, 20, and 29 through 31 are submitted herewith. Claims 15 through 21 and 29 through 36 are pending in the present application.

### **Miscellaneous**

Claims 30 and 31 are amended herein. The purpose of these amendments is to further improve the clarity of the claims by rectifying several apparent clerical and typographical errors. Thus, an unintentionally omitted portion of claim 30 has been restored, and a flawed antecedent in claim 31 has been corrected. Claim 31 has also been amended to include explicit Markush language. A basis for these amendments may be found in claim 8 as originally filed, for example.

The Title of the Invention has been amended according to the Examiner's suggestion. Also, the informalities noted by the Examiner in claims 18 and 20 are rectified herein.

It is believed that no new matter has been introduced into the application as a result of these amendments, and that the scope of claims 18, 20, and 31 is not altered as a result of these amendments.

The present application cites an incorrect Attorney Docket Number. The correct Attorney Docket No. is NC83175. Applicant respectfully requests the Examiner to correct the Attorney Docket No. in the U.S. Patent and Trademark Office records.

### **Rejections under 35 U.S.C. § 102(b)**

Claims 17, 20, 21, 29, and 34-36 have been rejected as allegedly anticipated by U.S. Patent No. 5,661,345, issued to Wada et al. (hereinafter "Wada"). Claims 16, 18, 19, 29, and 34-36 have also been rejected as allegedly anticipated by U.S. Patent No. 5,498,909, issued to Hasunuma et al. (hereinafter "Hasunuma"). Applicants respectfully traverse these rejections for the reasons set forth below.

It is well established that “to anticipate a claim, the reference must teach every element of the claim.” See M.P.E.P. § 2131. The same section continues, quoting numerous precedential decisions of the Court of Appeals for the Federal Circuit:

"A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). "The identical invention must be shown in as complete detail as is contained in the ... claim." *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989).

Applicants respectfully submit that the cited references do not, in fact, identically disclose the invention claimed in the present application.

The present application includes only one independent claim, claim 29. Claim 29 requires that “a single crystal transition metal” be formed on the barrier layer. The specification, on page 29 at lines 15-20, clarifies this requirement for monocrystallinity, stating that “the metal layer is devoid or essentially devoid of crystalline defects that are electron scatterers.” By contrast, although Wada suggests that the copper film should be a single crystal, in fact, in column 11 at lines 53-56, the copper layer is described as possessing only “enlargement of grain size” and “superior orientation characteristic[s].” Thus, the transition metal layer of Wada falls considerably short of the requisite monocrystallinity in claim 29.

Moreover, Applicants respectfully submit that this rejection is rendered moot by the amendment to claim 29 presented herein. Newly amended claim 29 requires that the barrier layer include a monolayer of metal atoms selected from strontium, barium, and/or cesium. A basis for this amendment may be found in the specification on page 7 at lines 17 to 19, on page 8 at lines 11 to 14, and in the claims as originally filed, *inter alia*; thus, it is believed that no new matter is introduced as a result of this amendment. Wada neither teaches nor suggests that its metal layers should include a monolayer of metal atoms selected from strontium, barium, and/or cesium. Accordingly, Wada does not identically set forth the claimed invention.

Since claims 17, 20, 21, and 34-36 depend from claim 29, and, since claim 29 is not anticipated by Wada, it follows by statute that claims 17, 20, 21, and 34-36 are also not anticipated by Wada.

With respect to the rejection of claim 29 citing Hasunuma, Applicants respectfully submit that this rejection is also rendered moot by the amendment to claim 29 presented herein. Claim

29, as amended, requires that the barrier layer include a monolayer of metal atoms selected from strontium, barium, and/or cesium. None of the barrier layers in Hasunuma, however, includes a monolayer of metal atoms selected from strontium, barium, and/or cesium. Nor is there any teaching or suggestion in Hasunuma regarding any alkaline earth metal. It is apparent, then, that Hasunuma also does not identically set forth the claimed invention.

Again, claims 16, 18, 19, and 34 to 36 depend from claim 29. Because claim 29 is not anticipated by Hasunuma, it follows by statute that claims 16, 18, 19, and 34-36 are also not anticipated by Hasunuma.

Applicants therefore respectfully request that the rejections under 35 U.S.C. § 102(b) be withdrawn upon reconsideration.

#### **Rejections under 35 U.S.C. § 103(a)**

Claims 16, 18, 19, 32, and 33 have been rejected as allegedly rendered obvious by Wada in view of Hasunuma. Claims 17, 20, 29-34, and 36 have been rejected as allegedly rendered obvious by U.S. Patent No. 5,387,459 issued to Hung et al. (hereinafter “Hung”) in view of Wada. Claims 16-21, 29, and 32-36 stand rejected as allegedly rendered obvious by U.S. Patent No. 6,077,774 issued to Hong et al. (hereinafter “Hong”) in view of Wada or Hasunuma. Finally, claims 15 and 30-33 have been rejected as allegedly rendered obvious by Wada or Hasunuma in view of U.S. Patent No. 6,291,876 issued to Stumborg et al. (hereinafter “Stumborg”). Applicants respectfully traverse these rejections for the reasons set forth below.

First, with respect to the rejection of claims 15 and 30-33 under 35 U.S.C. § 103(a) as allegedly obvious over Wada or Hasunuma in further view of Stumborg, Applicants respectfully submit that the provisions of 35 U.S.C. § 103(c) apply. That is, the present application and the Stumborg patent were, at the time the claimed invention was made, owned by or subject to an obligation of assignment to the United States of America as represented by the Secretary of the Navy. By statute, then, the Stumborg reference may not preclude the patentability of the claimed invention. Applicants therefore respectfully request that this rejection be withdrawn upon reconsideration.

Second, Applicants respectfully submit that the Official Action does not set forth a *prima facie* case of obviousness in support of the other rejections under 35 U.S.C. § 103(a). According to M.P.E.P. § 2143,

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, **the prior art reference (or references when combined) must teach or suggest all the claim limitations.**

The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in applicant's disclosure. [*Citation omitted; emphasis supplied.*]

As demonstrated by the above discussion, Wada and Hasunuma do not contain all the limitations of claim 29. To reiterate, neither Wada nor Hasunuma teaches or suggests that the barrier film should include a monolayer of metal atoms selected from strontium, barium, and/or cesium. Thus, Applicants respectfully submit that claim 29 is not rendered obvious by the combination of Wada and Hasunuma.

With respect to the rejection of claim 29 over Hung in view of Wada, this combination of references neither teaches nor suggests all of the limitations of newly amended claim 29. Although Hung describes a buffer layer 15 between a substrate 13 and an electrode 17, the buffer layer 15 is a metal oxide or an alkaline earth metal fluoride. Hung neither teaches nor suggests that the barrier layer should contain a monolayer of metal atoms selected from strontium, barium, and/or cesium, as required by newly amended claim 29.

Finally, with respect to the rejection of claim 29 over Hong in view of Wada or Hasunuma, once more, this combination of references neither teaches nor suggests all of the limitations of newly amended claim 29. Although Hong includes a metal layer 14, which may comprise copper, the barrier film 15 in Hong is a metal oxide or a metal carbide. *See* Hong col. 3 at lines 15 to 20. Likewise, even though metal layer 28 may comprise copper, barrier 22 is described as the top of dielectric layer 12. Dielectric layer 12 may be formed of any dielectric material, for example, silica, borophosphosilicate glass, or a polymer. *See* Hong col. 2 at line 63 to col. 3 at line 4. Hong does not teach or suggest, however, that barrier 22 or barrier film 15 should contain a monolayer of metal atoms selected from strontium, barium, and/or cesium, as required by newly amended claim 29.

Applicants therefore respectfully request that the rejections of claim 29 under 35 U.S.C. § 103(a) be withdrawn upon reconsideration.

Claims 16-21 and 30-36 depend, directly or indirectly, from claim 29. Because claim 29 is not obvious in light of the cited references, it follows by statute that claims 16-21 and 30-36 are also not obvious. Accordingly, Applicants respectfully request that the rejections of these claims under 35 U.S.C. § 103(a) also be withdrawn upon reconsideration.


### **Conclusion**

In view of the foregoing amendments and remarks, Applicants respectfully submit that all of the pending claims are in condition for allowance and respectfully request a favorable Office Action so indicating.

Respectfully submitted,

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Appendix: Claims with Amendments Marked

**APPENDIX : CLAIMS WITH AMENDMENTS MARKED**

18. (Twice amended) A process for making a semiconductor device according to claim 29, wherein the forming of the single crystal transition metal on the barrier film comprises depositing a transition metal on the barrier film concurrent with heating the substrate and barrier film surface to approximately 375°C or higher.
20. (Twice amended) A process for making a semiconductor device according to claim 29, wherein the forming of the single crystal transition metal on the barrier film comprises the substeps of depositing a transition metal on the barrier film at a temperature below 375°C, and then annealing the resulting metallized substrate at a temperature of 375°C or higher.
29. (Amended) A process of making a semiconductor device comprising the steps of: forming, on a surface of a substrate material, a barrier film comprising a monolayer of metal atoms, said metal atoms being selected from the group consisting of barium, strontium, and cesium atoms, singly or in combinations thereof; and forming a single crystal transition metal on the barrier film.
30. (Amended) A process for making a semiconductor film according to claim 29, wherein the barrier film comprises a heteroepitaxial film structure comprising the monolayer of metal atoms located on said surface of said substrate, and a homoepitaxial portion comprised of a metal halide selected from barium halide, strontium halide, and cesium halide, located between the monolayer and the transition metal.
31. (Amended) A process for making a semiconductor device according to claim 30, wherein the homoepitaxial portion of the barrier film is comprised of a metal halide selected from the group consisting of BaF<sub>2</sub>, BaCl<sub>2</sub>, SrF<sub>2</sub>, SrCl<sub>2</sub>, CsF, and CsCl.